# Technical note

Planetary pressures-adjusted Human Development Index (PHDI)

The Planetary pressures-adjusted Human Development Index (PHDI) is an experimental index that adjusts the Human Development Index (HDI) for planetary pressures in the Anthropocene. The PHDI discounts the HDI for pressures on the planet to reflect a concern for intergenerational inequality, similar to the Inequality-adjusted HDI adjustment which is motivated by a concern for intragenerational inequality. It is computed as the product of the HDI and (1 − index of planetary pressures) where (1 − index of planetary pressures) can be seen as an adjustment factor.

The PHDI is the level of human development adjusted by carbon dioxide emissions per person (production-based) and material footprint per capita to account for the excessive human pressure on the planet. It should be seen as an incentive for transformation. In an ideal scenario where there are no pressures on the planet, the PHDI equals the HDI. However, as pressures increase, the PHDI falls below the HDI. In this sense, the PHDI measures the level of human development when planetary pressures are considered.

Figure 1: Relationship between the HDI, PHDI and components
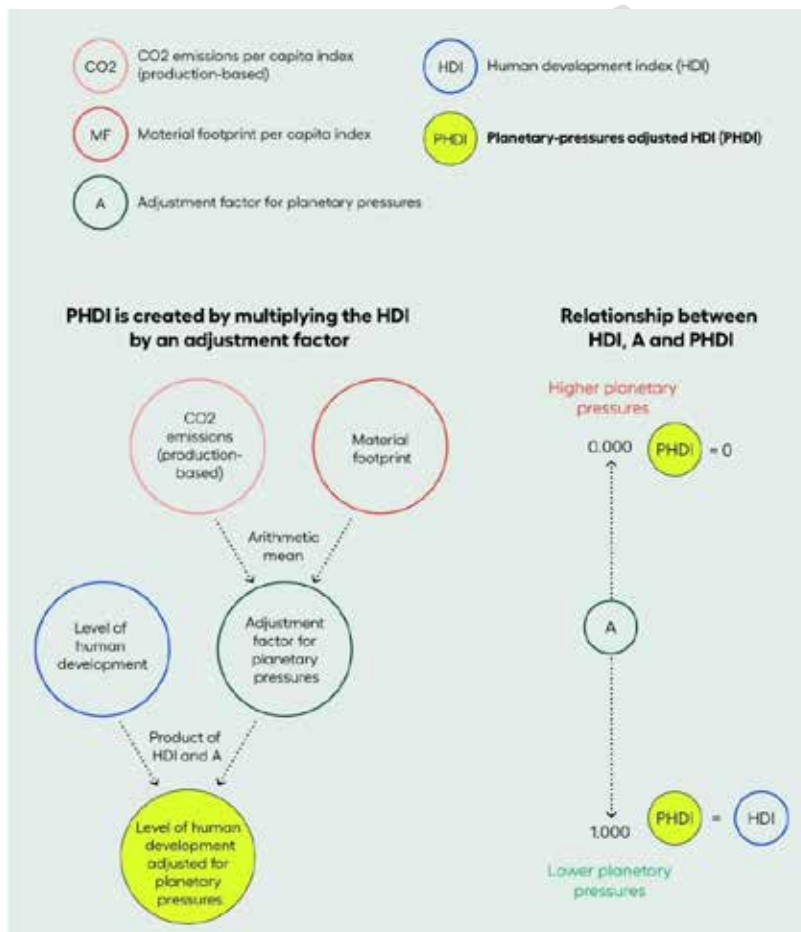
Indicator definitions and data sources

In addition to the data used to calculate the HDI, the PHDI uses data on carbon dioxide (CO_2) emissions per person (production-based) and material footprint per capita.

> Carbon dioxide emissions per person (production): carbon dioxide emissions produced as a consequence of human activities (use of coal, oil and gas for combustion and industrial processes, gas flaring and cement manufacture), divided by midyear population. Values are territorial emissions, meaning that emissions are attributed to the country in which they physically occur. Source: Global Carbon Project (2020). Global Carbon Atlas. http://www.globalcarbonatlas.org/en/CO2-emissions . Accessed 27 August 2020.

> Material footprint per capita: Material Footprint (MF) is the attribution of global material extraction to domestic final demand of a country. This indicator is calculated as raw material equivalent of imports plus domestic extraction minus raw material equivalents of exports. The total material footprint is the sum of the material footprint for biomass, fossil fuels, metal ores and non-metal ores. Per-capita MF describes the average material use for final demand. Source: United Nations Environment Programme (2020). World Environment Situation Room, Data downloader. https://environmentlive.unep.org/downloader . Accessed 17 September 2020.

Steps to calculate the Planetary pressures-adjusted Human Development Index (PHDI)

There are three steps to calculating the PHDI.

Step 1. **Calculating the CO_2 emissions index and the MF index**

CO_2 emissions per person and MF per capita are normalized in the same way as the components of the HDI, through a min-max transformation, each becomes an index with values between 0 and 1 calculated as:

$$A_j \text{ index} = (\text{maximum}_j - \text{observed value}_j)/(\text{maximum}_j - \text{minimum}_j)$$

where j=1,2 refers to the 2 included planetary pressure indicators.

Zero was set as minimum. The maximum corresponds to the maximum value observed historically for all countries since 1990, in line with the similar approaches in the literature, as in Biggeri and Mauro (2018). For CO2 emissions per person, a maximum value of 69.85 tonnes per person was observed for Qatar in 1997. For MF per capita, a maximum value of 152.58 was observed for Guyana in 2000. It is important to note that the ranking of countries is sensitive to the selection of the maximum.

For both, CO_2 emissions per person and MF per capita, the higher the observed value and the closer to the maximum, the higher the pressure to the planet, implying a smaller value of the index and a larger adjustment to the HDI.

Step 2. Constructing the Adjustment for planetary pressures index

The adjustment factor for planetary pressures (A) is the arithmetic average of indices measuring CO_2 emissions per person and material footprint per capita, which assumes perfect substitution of these 2 indicators. Lower pressures to the planet result in a larger A and smaller discounts to the HDI (see Figure 1).

$$A = (CO_2 \text{ emissions index} + \text{MF index})/2$$

Additionally, the index pf planetary pressures, P, is defined as the complement of A, then, P= (1-A).

Step 3. Adjusting the HDI to account for planetary pressures

The planetary pressures-adjusted HDI is the product of the HDI and the adjustment factor A:

$$PHDI = HDI * A,$$

or, equivalently, PHDI = HDI * (1-P).

The overall loss in the Human Development Index due to planetary pressures, or percentage difference between the HDI and the PHDI values, is:

$$Loss = \left(\frac{HDI - PHDI}{HDI}\right) * 100 = P * 100$$

Example: Iceland

Human Development Index (HDI)	0.949
Carbon dioxide emissions per capita (production), tonnes	10.8
Material footprint per capita	34.8
Carbon dioxide emissions index	(69.85 - 10.8)/69.85 = 0.846
Material footprint index	(152.58 - 34.8)/152.58 = 0.772
Adjustment for planetary pressures factor (A)	(0.846+0.772)/2 = 0.809
Planetary pressures-adjusted HDI (PHDI)	0.949 * 0.809 = 0.768
Overall loss (%)	((0.949 - 0.768)/0.949) * 100 = 19.1

Note: Values are rounded.

Why is the Human Development Report Office releasing the PHDI?

The PHDI has been developed to signal changes that are needed to navigate the Anthropocene. This index can help assess and encourage action that both advances human development and eases planetary pressures.

The proposed adjustment to the HDI recognizes that easing the disruptions of planetary processes require reducing CO_2 emissions and closing material cycles.

The PHDI focuses on CO_2 emissions and material flows but this does not imply that all other environmental concerns are less important or urgent, though reductions in the two included indicators reflect a move towards the transformation that is needed to ease some of the biggest pressures on the planet.

What is the interpretation of the PHDI?

The PHDI suggests that progress in human development has increased at a slower rate because planetary pressures have also risen.

One must be careful in interpreting the PHDI because it does not account for individual countries' responsibilities—current or historical.

The trajectory of countries over the last three decades shows different paths for different levels of human development. Countries with low and medium levels of human development have been able to improve significantly social and economic conditions without imposing a high burden on planetary balances. But improvements in wellbeing and rising pressure on the planet have been coupled in countries with high and very high human development.

The PHDI is intended to incentivise change, providing a metric for countries to assess their own progress over time, highlighting those countries that are moving in the right direction so that others can learn from them. This interpretation is also consistent with the open-endedness of the human development journey in the Anthropocene. It is meant to provide a sense of possibility: how to achieve high levels of the HDI with lower emissions and resource use.

References

Biggeri, M., and Mauro, V. 2018. "Towards a More 'Sustainable' Human Development Index: Integrating the Environment and Freedom." Ecological Indicators 91: 220-231.